Determination of the mass and half-life of a boson generated from an energy level of zero value

Author:
Fernando Salmon
Bachelor' s in Physics from the Complutense University of Madrid UCM and Master´s in Mathematics and Computing from the University of Cantabria UC (Spain)

fernandosalmoniza@gmail.com

Keywords

Klein-Gordon equation., cosmology, bosons, quantum mechanics, early universe.

Abstract

A recent study based on knowledge about the shape of our universe has shown that its origin probably had to occur from a state of zero energy. In this paper we study the possibility of creating matter by analyzing the solutions of the Klein-Gordon equation for a quantum state of zero energy. An analytical solution is found in this regard.

1. Search for the mathematical solution.

By studying the shape of our universe, it has recently been determined [1] that its origin was most likely from a state of zero energy. To answer the question of whether it is possible to create matter from a state of zero energy from our knowledge of quantum mechanics and quantum field theory, I have studied the Klein-Gordon equation and its solutions and have found a positive quantitative answer to the problem. All this is detailed below.

To demonstrate that the bosonic physical system generated from a quantum state of zero energy can exist, we are going to study the Klein-Gordon equation in detail.

In the case of a problem with spherical symmetry the Klein-Gordon equation is:

$$E\psi = -(h^2/8\pi^2 m)\,(\eth\psi/(\eth^2 r)) + mc^2\psi$$

I study a wave function $\varphi(r)$

$$E\varphi(r) = -(h^2/8\pi^2 m)\,\varphi(r)^{``} + mc^2\varphi(r)$$

Setting the energy of the quantum state, E, equal to zero, E=0, result:

$(h^2/8\pi^2)\ \varphi(r)`` = m^2c^2\ \varphi(r)$

$(h^2/8\pi^2)\ \varphi(r)`` = m^2c^2\ \varphi(r)$

$k^2 = m^2c^2.8\pi^2/h^2$

$k = 9mc/h$

$\varphi = e^{-kr} = e^{,9mcr/h}$

Normalizing the wave function to unity so that it represents a probability, the result

k=1= 9mc/h

mc = k.h/9

$mc^2 = k.h.c/9 = 6{,}62.10^{-34}.3.10^8/9 = 2.10^{-26}$

boson mass

k=1= 9mc/h

$m = h/9c = 6{,}62.10^{-34}/9.(3.10^8) = 0{,}25.10^{-42}$ Kg $= 14.10^{-8}$eV

In accordance with the Heisenberg uncertainty relations and in order not to violate the principle of conservation of energy, the half-life of the particle turn out to be:

$(\Delta E).\ (\Delta t) \geq h$

$(\Delta E) = mc^2 = 2.10^{-26}$ Joules

boson half-life

$\Delta t = \Delta E/h = 3.10^{-8}$ sg = 30 nanoseconds

2. Conclusions

Searching for solutions to the problem of self-creation of mass from zero energy states using equations of quantum mechanics and field theory, I have found a solution to the Klein-Gordon equation that represents a bosonic physical system generated from a quantum state. of zero energy which results in a positive mass of 14.10^{-8} eV. So that the principle of conservation of energy is not violated, and in accordance with the Heisenberg uncertainty principle, I have calculated its half-life, which turns out to be 30 nanoseconds. This boson, according to the solution found, presents a mass-energy, mc^2, of value 2.10^{-26} Joules

3. References

[1] Melia, Fulvio. 2022 Initial energy of a spatially flat universe: A hint of its possible origin. Astronomische Nachrichten, Volume 343, Issue 3, article id. e24010

[2] [Jiménez García, F N; Ortiz Álvarez, H H; Posso Agudelo, Abel Enrique. 2012. Some Exact Solutions for a Klein Gordon Equation. Universidad EAFIT

[3] Emilio Santos-Corchero. October 2021 Realistic Interpretation of Quantum Mechanics. Revised version submitted to Cambridge Scholars Publishing www.cambridgescholars.com

[4] Can the Universe create itself. 1998.,Got J. Richard III, Li, Li-Xin Physical Review D (Particles, Fields, Gravitation, and Cosmology), Volume 58, Issue 2, 15 July 1998, id. 023501